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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Wong et al.		
Assignee:	Maxtor Corporation		
Title:	MAGNETIC RECORDING MEDIA HAVING ADJUSTABLE COERCIVITY USING MULTIPLE MAGNETIC LAYERS AND METHOD OF MAKING SAME		
Serial No.:	09/584,764	Filed:	May 30, 2000
Examiner:	Rickman, H.	Group Art Unit:	1773
Atty. Docket No.:	MM0011		

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APPEAL BRIEF
(37 C.F.R. § 1.192)

This Appeal Brief is in furtherance of the Notice of Appeal filed concurrently herewith.

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This paper is submitted in triplicate.

08/11/2003 AWONDAF1 00000055 130016 09584764
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The index of subject matter is as follows:

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Maxtor Corporation.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Total Number of Claims in Application

Claims in the application are: 1-60

B. Status of All Claims

1. Claims canceled: NONE
2. Claims withdrawn: NONE
3. Claims pending: 1-60
4. Claims allowed: 1-10 and 51-60
5. Claims rejected: 11-23 and 27-50 (24-26 objected to)

C. Claims on Appeal

Claims on appeal are: 11-23 and 27-50

IV. STATUS OF AMENDMENTS

No amendments have been filed after the outstanding Office Action dated July 29, 2003.

V. SUMMARY OF INVENTION

The present invention is directed to providing an optimum medium coercivity between the coercivities of the first and second magnetic layers by adjusting the thickness of the first and second magnetic layers (Substitute Specification, page 2, lines 11-20).

As illustrated, a magnetic recording disk includes includes substrate 4, seed layer 6, chromium-based layer 8, magnetic layers 10-1 and 10-2, carbon overcoat 12 and lubricant 14 (Substitute Specification, page 3, lines 8-16 and Figure 3). Changing the thickness ratio (Q) between magnetic layers 10-1 and 10-2 can modify the coercivity of the structure while keeping the remanence of the structure constant (Substitute Specification, page 3, lines 17-25). Results demonstrate that varying the thickness ratio of the magnetic layers has a significant effect on coercivity with little or no effect on remanence (Substitute Specification, page 4, lines 12-14 and Figures 4-7).

VI. ISSUES

The issues on appeal are (1) whether claims 11-20 and 31-50 contain subject matter not described in the specification under 35 U.S.C. § 112, first paragraph, (2) whether claim 29 contains subject matter not described in the specification under 35 U.S.C. § 112, first paragraph, (3) whether claims 21-22, 27 and 29-30 are anticipated under 35 U.S.C. § 102(e) or in the alternative obvious under 35 U.S.C. § 103(a) in view of *Bian et al.* (U.S. Patent No. 6,143,388), and (4) whether claims 23 and 28 are unpatentable under 35 U.S.C. § 103(a) in view of *Bian et al.*

VII. GROUPING OF CLAIMS

For the first issue, the claims stand and fall together.

For the second issue, claim 29 is the sole claim.

For the third issue, the claims do not stand and fall together and are grouped as follows: (i) claims 21-22, 27 and 30, and (ii) claim 29.

For the fourth issue, the claims do not stand and fall together and are grouped as follows: (i) claim 23, and (ii) claim 28.

VIII. ARGUMENTS

I. SECTION 112, FIRST PARAGRAPH REJECTIONS – CLAIMS 11-20 AND 31-50

Claims 11-20 and 31-50 are rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 11 recites "the second alloy composition not containing more boron by atomic percentage than the first alloy composition." Claim 20 recites "the first quaternary alloy composition contains as much or more boron by atomic percentage than the second quaternary alloy composition." Claim 31 recites "the second alloy composition does not contain more boron by atomic percentage than the first alloy composition." Claim 41 recites "the second alloy composition does not contain more boron by atomic percentage than the first alloy composition."

In sustaining this rejection, the Examiner states as follows:

> The specification as originally filed fails to provide support for the claimed concept of a first alloy composition containing as much as or more boron as a second alloy composition. Several examples are provided wherein this relationship between the amount of boron in the first and second layer is as claimed. However, this merely indicates that Applicant has support for a structure having those specific alloy compositions.

The Specification describes the magnetic layer compositions as follows:

> The multi-magnetic layer structure can comprise cobalt alloys with different alloying elements including one or more of chromium, platinum, tantalum, boron, niobium, molybdenum, nickel, tungsten, carbon, aluminum, iron, and manganese. (Substitute Specification, page 3, lines 28-30.)

As illustrated in the graphs of Figs. 4-7 for specific embodiments, by changing the relative thicknesses of the magnetic layers a change in coercivity is realized while keeping remanence, deposition conditions, and underlayer thickness constant. An optimum coercivity can be realized solely by the variation in thicknesses of the magnetic layers. (Substitute Specification, page 4, lines 1-4.)

In Fig. 4 the effect of film fraction Q on coercivity (Hr), remanence (Mrt) and coercive squareness (S*) are illustrated for a first layer of Co-20Cr-10Pt-8B and a second layer of Co-22Cr-10Pt-6B. Coercivity is given in kiloOersterd (kOe) while remanence and coercive squareness are given in relative units. (Substitute Specification, page 4, lines 5-8.)

In Fig. 5 the first magnetic layer is Co-20Cr-10Pt-8B and the second layer is Co-26Cr-10Pt-6B, while in Fig. 6 the first magnetic layer is an alloy of Co-20Cr-10Pt-8B and the second layer is Co-20Cr-8Pt-4Ta. In Fig. 7 the first magnetic layer is Co-20Cr-8Pt-4Ta and the second magnetic layer is Co-18Cr-6Pt-3Ta. In each of the figures it will be noted that varying the ratio Q has a significant effect on coercivity with little or no effect on remanence and sharpness. (Substitute Specification, page 4, lines 9-14.)

While the invention has been described with reference to specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. For example, while two magnetic layers are described in each of the embodiments, more than two magnetic layers can be employed. Thus, various modifications and applications may occur to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims. (Substitute Specification, page 4, lines 15-20.)

The Specification makes clear that the magnetic layers can include a wide variety of cobalt alloys with different alloying elements including (but not requiring) boron. The Specification also provides four examples for the first and second magnetic layers:

Example	First Magnetic Layer	Second Magnetic Layer
1.	Co-20Cr-10Pt-8B	Co-22Cr-10Pt-6B
2.	Co-20Cr-10Pt-8B	Co-26Cr-10Pt-6B
3.	Co-20Cr-10Pt-8B	Co-20Cr-8Pt-4Ta
4.	Co-20Cr-8Pt-4Ta	Co-18Cr-6Pt-3Ta

In all four of the examples, the second alloy composition does not contain more boron by atomic percentage than the first alloy composition. Thus, all four examples support claims 11, 31 and 41.

In all four examples, the first alloy composition has a first quaternary alloy composition, the second alloy composition has a second quaternary alloy composition, and the first quaternary alloy composition contains as much or more boron by atomic percentage than the second quaternary alloy composition. Thus, all four examples support claim 20.

Therefore, the Specification reasonably conveys the first alloy composition containing as much or more boron as the second alloy composition. Further statements to this effect would be redundant and unenlightening.

II. SECTION 112, FIRST PARAGRAPH REJECTION – CLAIM 29

Claim 29 is rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 29 recites "the second alloy composition excludes boron."

In sustaining this rejection, the Examiner states as follows:

> The specification as originally filed fails to provide support for the claimed concept of a first alloy composition containing as much as or more boron as a second alloy composition. Several examples are provided wherein this relationship between the amount of boron in the first and second layer is as claimed. However, this merely indicates that Applicant has support for a structure having those specific alloy compositions.

The Specification, as mentioned above, makes clear that the magnetic layers can include a wide variety of cobalt alloys with different alloying elements including (but not requiring) boron.

The Specification, as mentioned above, also provides four examples for the first and second magnetic layers:

Example	First Magnetic Layer	Second Magnetic Layer
1.	Co-20Cr-10Pt-8B	Co-22Cr-10Pt-6B
2.	Co-20Cr-10Pt-8B	Co-26Cr-10Pt-6B
3.	Co-20Cr-10Pt-8B	Co-20Cr-8Pt-4Ta
4.	Co-20Cr-8Pt-4Ta	Co-18Cr-6Pt-3Ta

In the third and fourth examples, the second alloy composition excludes boron. Thus, the third and fourth examples support claim 29.

Therefore, the Specification reasonably conveys the second alloy composition excluding boron. Further statements to this effect would be redundant and unenlightening.

III. SECTION 102/103 REJECTIONS – BIAN ET AL.

Claims 21-22, 27 and 29-30 are rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over *Bian et al.* (U.S. Patent No. 6,143,388).

Bian et al. discloses a magnetic disk with onset layer 14 and magnetic layer 15. Onset layer 14 is a magnetic or nonmagnetic layer such as CoCrTa, CoCrB, CoPtCrTa or CoPtCrB, and magnetic layer 15 is CoPtCrB. Magnetic layer 15 is a quaternary boron alloy with a tendency to orient with the C-axis vertical to the plane of the substrate. Onset layer 14 promotes magnetic layer 15 having an hcp growth pattern with the C-axis strongly in plane.

Claims 21-22, 27 and 30 (Group I)

Claim 21 recites "varying a thickness fraction of the thickness of the first magnetic layer to the thickness of the first and second magnetic layers changes the coercivity of the medium a first percentage, changes the remanence of the medium a second percentage, and the first percentage is at least twice the second percentage." *Bian et al.* fails to teach or suggest anything remotely similar to this. In particular, *Bian et al.* says nothing about the relative coercivities and remanences of onset layer 14 and magnetic layer 15, much less that that varying the thickness of onset layer 14 relative to the thickness of onset layer 14 and magnetic layer 15 would change to coercivity of the magnetic disk a first percentage, would change the remenance of the magnetic disk a second percentage, and the first percentage would be at least twice the second percentage.

In sustaining this rejection, the Examiner states as follows:

> Bian et al. disclose a magnetic recording medium having a non-magnetic substrate formed from NiP, an underlayer, a magnetic onset layer formed from CoPtCrTa and a magnetic recording layer formed from CoPtCrB. The reference fails to disclose the claimed relationship between the coercivities of the individual layers and the overall covercivity of the medium.

> However, it is the Examiner's contention that the claimed coercivity limitations are inherent in Bian's disclosure. The reference teaches that the onset and recording layers having different thicknesses and compositions. As such, one of ordinary skill in the art can conclude that the layers have different coercivities. Furthermore, one of ordinary skill in the art can conclude that the total coercivity of the medium will not be the same as that of the coercivities of the individual layers since the Hc values of the individual layers are not equal. Furthermore, it is the Examiner's contention that varying the thickness fraction of the first and second magnetic layers inherently results in the claimed relationship between the change in coercivity and the change in remanence.

This conclusory assertion is completely unsupported. The Examiner has failed to explain how or why the claimed coercivity and remanence characteristics would automatically occur in *Bian et al.*

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applies prior art. See M.P.E.P. § 2112.

Under 35 U.S.C. §102, anticipation requires that each and every element of the claimed invention be disclosed in the prior art. *Akzo N.V. v. United States International Trade Commission*, 1 USPQ 2d 1241, 1245 (Fed. Cir. 1986), *cert. denied*, 482 U.S. 909 (1987). That is, the reference must teach every aspect of the claimed invention. M.P.E.P. § 706.02.

To establish a prima facie case of obviousness (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings; (2) there must be a reasonable expectation of success; and (3) the prior art reference (or

references when combined) must teach or suggest all the claim limitations (MPEP § 2143). See also *C.R. Bard, Inc. v. M3 Systems, Inc.*, 157 F.3d 1340, 1351 (Fed. Cir. 1998). It is insufficient that the prior art shows similar components unless it also contains some teaching, suggestion or incentive for arriving at the claimed structure. See *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 934 (Fed. Cir. 1990).

Moreover, if the proposed modification would render the prior art unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification (M.P.E.P. § 2143.01).

Claim 29 (Group II)

Claim 29 distinguishes over *Bian et al.* for the reasons set forth above for the Group I claims and further distinguishes over *Bian et al.* on its own merits since it recites another limitation that is not disclosed by *Bian et al.*

Claim 29 recites "the second alloy composition excludes boron." *Bian et al.* fails to teach or suggest that magnetic layer 15 excludes boron. Unfortunately, the Examiner has not even attempted to address this limitation.

IV. SECTION 103 REJECTIONS – BIAN ET AL.

Claims 23 and 28 are rejected under 35 U.S.C. § 103(a) as unpatentable over *Bian et al.*

Claim 23 (Group I)

Claim 23 distinguishes over *Bian et al.* for the reasons set forth above for claim 21

Claim 28 (Group II)

Claim 28 distinguishes over *Bian et al.* for the reasons set forth above for the Group I claim and further distinguishes over *Bian et al.* on its own merits since it recites another limitation that is not disclosed by *Bian et al.*

Claim 28 recites "the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-20Cr-8Pt-4Ta." *Bian et al.* fails to teach or suggest that onset layer 14 includes 8 atomic percentage boron or that magnetic layer 15 excludes boron.

In sustaining this rejection, the Examiner states as follows:

> Bian et al. disclose a magnetic onset layer having the composition 4-14 at% Pt, 10-23 at% Cr, 1-5 at% Ta, balance Co (col. 3, lines 51-54). The reference also teaches that the magnetic layer is formed from 4-12 at% Pt, 10-23 at% Cr, 2-10 at% B, balance cobalt (col. 8, claim 22). It would have been obvious to one of ordinary skill in the art at the time of the invention to choose suitable amounts of each element from within the disclosed ranges in order to produce magnetic layers having the desired magnetic properties.

Bian et al. discloses that onset layer 14 can be CoPtCrTa containing 1-5 atomic percent Ta, and B can be substituted for Ta. However, even if the substitution was made, yielding onset layer 14 as CoPtCrB containing 1-5 atomic percent B, the first alloy composition Co-20Cr-10Pt-8B would not fall within this range since it contains 8 atomic percent B. Moreover, magnetic layer 15 would not exclude boron regardless of the composition of onset layer 14.

CONCLUSION

For the reasons given above, Applicant respectfully submits that claims 11-23 and 27-50 are in condition for allowance and respectfully requests that the outstanding rejections be overturned.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on August 4, 2003.

D Sigmond — 8/4/03

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Date of Signature

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IX. APPENDIX OF CLAIMS INVOLVED IN THE APPEAL

11. A magnetic recording medium, comprising:

a substrate;

an underlayer supported by the substrate;

a first magnetic layer on the underlayer, said first magnetic layer having a first alloy composition that includes Pt and a first coercivity; and

a second magnetic layer on and in contact with the first magnetic layer, the second magnetic layer having a second alloy composition that includes Pt which differs from the first alloy composition and a second coercivity which differs from the first coercivity, the second alloy composition not containing more boron by atomic percentage than the first alloy composition, whereby a coercivity of the two magnetic layers is different than the first and second coercivities and is determined by a relative thickness of the first magnetic layer to the thickness of the two magnetic layers.

12. The magnetic recording medium as defined by claim 11 wherein the thickness of each magnetic layer is between 2 nm and 50 nm.

13. The magnetic recording medium as defined by claim 11 wherein each of the two magnetic layers comprise an alloy of cobalt with at least one of chromium, platinum, tantalum, boron, niobium, molybdenum, nickel, tungsten, carbon, aluminum, iron, and manganese the thickness of each magnetic layer is between 2 nm and 50 nm.

14. The magnetic recording medium as defined by claim 13 wherein the first magnetic layer comprises an alloy having a composition of Co-20Cr-10Pt-8B and the second magnetic layer comprises an alloy having a composition of Co-22Cr-10Pt-6B.

15. The magnetic recording medium as defined by claim 13 wherein the first magnetic layer comprises an alloy having a composition of Co-20Cr-10Pt-8B, and the second magnetic layer comprises an alloy having a composition of Co-26Cr-10Pt-6B.

16. The magnetic recording medium as defined by claim 13 wherein the first magnetic layer comprises an alloy having a composition of Co-20Cr-10Pt-8B, and the second magnetic layer comprises an alloy having a composition of Co-20Cr-8Pt-4Ta.

17. The magnetic recording medium as defined by claim 13 wherein the first magnetic layer comprises an alloy having a composition of Co-20Cr-8Pt-4Ta, and the second magnetic layer comprises an alloy having a composition of Co-18Cr-6Pt-3Ta.

18. The magnetic recording medium as defined by claim 11 wherein the substrate is nickel phosphorus or ceramic glass, and the underlayer is chromium or chrome alloy.

19. The magnetic recording medium as defined by claim 18 and further including a seedlayer between the underlayer and the substrate, a carbon overcoat layer over the second magnetic layer, and a lubricant layer on the carbon overcoat layer.

20. A method for establishing a coercivity of magnetic recording material on a substrate comprising the steps of providing a substrate and first and second cobalt based alloy magnetic layers sputtered in sequence on the substrate and in contact with one another, wherein the first magnetic layer has a first quaternary alloy composition and a first coercivity, the second magnetic layer has a second quaternary alloy composition and a second coercivity, the first quaternary alloy composition contains as much or more boron by atomic percentage than the second quaternary alloy composition, with the relative thicknesses of the two magnetic layers determining the coercivity, and the coercivity being different than the first and second coercivities.

21. A magnetic recording medium, comprising:

a substrate;

a first magnetic layer over the substrate, wherein the first magnetic layer has a first alloy composition and a first coercivity; and

a second magnetic layer on and in contact with the first magnetic layer, wherein the second magnetic layer has a second alloy composition and a second coercivity, the first and second alloy compositions are different, the first and second coercivities are different, a coercivity of the medium is different than the first and second coercivities, and varying a thickness fraction of the thickness of the first magnetic layer to the thickness of the first and second magnetic layers changes the coercivity of the medium a first percentage, changes the remanence of the medium a second percentage, and the first percentage is at least twice the second percentage.

22. The magnetic recording medium as defined by claim 21 wherein the first and second alloy compositions are quaternary alloy compositions.

23. The magnetic recording medium as defined by claim 22 wherein the first and second alloy compositions have the same four elements.

27. The magnetic recording medium as defined by claim 22 wherein the first and second alloy compositions have the same three elements and a different fourth element.

28. The magnetic recording medium as defined by claim 27 wherein the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-20Cr-8Pt-4Ta.

29. The magnetic recording medium as defined by claim 21 wherein the second alloy composition excludes boron.

30. The magnetic recording medium as defined by claim 21 wherein the coercivity of the medium is determined by the thickness fraction $t_{Mag1}/(t_{Mag1} + t_{Mag2})$ where t_{Mag1} is the thickness of the first magnetic layer and t_{Mag2} is the thickness of the second magnetic layer.

31. A magnetic recording medium, comprising:

a substrate;

a first magnetic layer over the substrate, wherein the first magnetic layer has a first alloy composition and a first coercivity and is sputter deposited over the substrate under a first deposition condition that includes a temperature and bias of the substrate; and

a second magnetic layer on and in contact with the first magnetic layer, wherein the second magnetic layer has a second alloy composition and a second coercivity and is sputter deposited on the first magnetic layer under a second deposition condition that includes a temperature and bias of the substrate, the first and second alloy compositions are different compositions that contain Co and Pt, the second alloy composition does not contain more boron by atomic percentage than the first alloy composition, the first and second coercivities are different, the first and second deposition conditions are the same, and a coercivity of the medium is different than the first and second coercivities.

32. The magnetic recording medium as defined by claim 31 wherein the first and second alloy compositions are quaternary alloy compositions.

33. The magnetic recording medium as defined by claim 32 wherein the first and second alloy compositions have the same four elements.

34. The magnetic recording medium as defined by claim 33 wherein the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-22Cr-10Pt-6B.

35. The magnetic recording medium as defined by claim 33 wherein the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-26Cr-10Pt-6B.

36. The magnetic recording medium as defined by claim 33 wherein the first alloy composition is Co-20Cr-8Pt-4Ta and the second alloy composition is Co-18Cr-6Pt-3Ta.

37. The magnetic recording medium as defined by claim 32 wherein the first and second alloy compositions have the same three elements and a different fourth element.

38. The magnetic recording medium as defined by claim 37 wherein the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-20Cr-8Pt-4Ta.

39. The magnetic recording medium as defined by claim 31 wherein varying a thickness fraction of the thickness of the first magnetic layer to the thickness of the first and second magnetic layers changes the coercivity of the medium a first percentage, changes the remanence of the medium a second percentage, and the first percentage is at least twice the second percentage.

40. The magnetic recording medium as defined by claim 31 wherein the coercivity of the medium is determined by the thickness fraction $t_{Mag1}/(t_{Mag1} + t_{Mag2})$ where t_{Mag1} is the thickness of the first magnetic layer and t_{Mag2} is the thickness of the second magnetic layer.

41. A magnetic recording medium, comprising:

a substrate;

a first magnetic layer over the substrate, wherein the first magnetic layer has a first alloy composition and a first coercivity; and

a second magnetic layer on and in contact with the first magnetic layer, wherein the second magnetic layer has a second alloy composition and a second coercivity, the first and second alloy compositions are different quaternary alloy compositions, the second alloy composition does not contain more boron by atomic percentage than the first alloy composition, the first and second coercivities are different, and a coercivity of the medium is different than the first and second coercivities.

42. The magnetic recording medium as defined by claim 41 wherein the first and second alloy compositions include Co, Cr and Pt.

43. The magnetic recording medium as defined by claim 42 wherein the first and second alloy compositions have the same four elements.

44. The magnetic recording medium as defined by claim 43 wherein the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-22Cr-10Pt-6B.

45. The magnetic recording medium as defined by claim 43 wherein the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-26Cr-10Pt-6B.

46. The magnetic recording medium as defined by claim 43 wherein the first alloy composition is Co-20Cr-8Pt-4Ta and the second alloy composition is Co-18Cr-6Pt-3Ta.

47. The magnetic recording medium as defined by claim 42 wherein the first and second alloy compositions have the same three elements and a different fourth element.

48. The magnetic recording medium as defined by claim 47 wherein the first alloy composition is Co-20Cr-10Pt-8B and the second alloy composition is Co-20Cr-8Pt-4Ta.

49. The magnetic recording medium as defined by claim 41 wherein the second alloy composition excludes boron.

50. The magnetic recording medium as defined by claim 41 wherein the coercivity of the medium is determined by the thickness fraction $t_{Mag1}/(t_{Mag1} + t_{Mag2})$ where t_{Mag1} is the thickness of the first magnetic layer and t_{Mag2} is the thickness of the second magnetic layer.